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GUIDE SYLLABUS FOR IN-SERVICE STATISTICAL TRAINING

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INTRODUCTION

The attached Guide Syllabus has been prepared to assist African statistical offices in organizing in-service training courses. From information available to ECA, it appears that there are various types of in-service training which may be summarized in four main categories:

a) Daily release courses: Serving officers are released for one day or more a week to attend courses in the statistical office designed to improve their knowledge and performance;

b) Daily part-time course: In this approach the officers attend courses for a certain period each working day, say, two hours, and carry out their normal duties at other times;

c) Sandwich courses: As the name implies the officers undergo a period of training usually about two weeks full-time followed by a period of full-time work and another period of training of the same duration. In the course of the year there would be four or six sandwich courses of two weeks duration;

d) More formal in-service training: In this context officers are released to undergo full-time training for a period which could be as short as six weeks and as long as twelve months. Although this is full-time training, it differs from the training given for middle level personnel at statistical training centres in that the bulk of the training is limited to applications and very little theory or methods is taught.

It has not been possible to design a guide syllabus which takes into account all the four different scenarios outlined above. This guide syllabus has therefore been prepared on the assumption of 740 hours available for both the first and second stages of the course (i.e. approximately $4\frac{1}{2}$ months of full time or 9 months of part-time training for each stage, depending on the average number of hours available for part-time training during each working day). It should also be noted that Stage II is for those who have successfully completed Stage I. For those who do not have 'O' level passes in English and Mathematics or who obtained them too long ago, a preliminary course is prescribed. This course is self-contained but can also be used as a screening test for entry into Stage I. The preliminary stage syllabus makes provision for 240 hours.

In the Guide Syllabus an attempt has been made to obtain a proper balance between theory and applications. The word theory is being used here in its broadest sense to cover inter alia mathematics, statistical methods and basic economics.

It is planned that less than 50 per cent of the time available should be spent on such work and the rest should be devoted to applications. The following list of courses for the various stages and the number of hours to be devoted to each is given only as a guide.

1. PRELIMINARY STAGE

Subject	No. of hours
1.1 Mathematics	36
1.2 Statistical methods	36
1.3 Official statistics	108
1.4 Survey organization (Project work)	60
Total	240

2. FIRST STAGE

Subject	No. of hours	
2.1 Mathematics	40	
2.2 Basic economics	20	
2.3 English	20	
2.4 Elementary statistical methods	60	140
2.5 Official statistics		
a) Statistical organization	10	
b) Data collection, processing, analysis, publication and dissemination	60	
c) Agricultural statistics (including 4 hrs. field work)	30	
d) Economics statistics	70	
e) Demographic and social statistics	50	220
Total		360

3. SECOND STAGE

Subject	No. of hours	
3.1 Economics	45	
3.2 Mathematics	45	
3.3 Statistical theory and methods	60	
3.4 Elements of accounting	20	170

Subject		No. of hours	
3.5	Applied statistics		
	a) Agricultural statistics	30	
	b) Public sector statistics and financial institutions	15	
	c) Industrial statistics	15	
	d) National accounts	20	
	e) Labour and employment statistics	10	
	f) Transport and communications statistics	10	
	g) Demography	35	
	h) Health statistics	30	165
			45
	Total		380
	Total (Stages I + II) =		740

As already stated, the emphasis in the above syllabus has been placed on applications. Even in the theory and methods courses, applications will be accorded priority. In addition, practicals comprising home work and on-the-job applications which have not been elaborated upon in the allocation of formal contact hours will be an essential feature of the in-service training.

It should be noted that on completion of the first and second stages of the syllabus, the successful candidate should have acquired sufficient knowledge to qualify for entry into the Diploma course at any of the STPA centres, subject to language requirements. This can be demonstrated, for example, by comparing the course content and number of hours allocated. The following comparison between the guide syllabus for the normal programme for the certificate level at English-speaking training centres and that suggested for in-service training above aptly demonstrates the approximate equivalence of the two programmes:

	Hours	
Subject	STPA certificate level	In-service (Stages I + II)
Economics	64	65
Mathematics	96	85
French	64	--
Statistical Theory and Methods	154	120
Applied Statistics	190	450
English	--	20
Total class hours	568	740

Since the practicals for in-service training are structured differently from those for the certificate level, no comparisons are made in that connexion.

The Guide Syllabus should be adapted to suit conditions in individual countries.

1.1 Mathematics

a) Fractions, mixed numbers and decimals: addition, subtraction, multiplication and division. Applications to statistical problems.

b) Percentages: Fractions as percentages and percentages as fractions. Increase and decrease in percentage. Applications to statistical problems.

c) Algebraic expressions and equations: Introduction to algebra; fundamental operations with algebraic expressions; simplifying expressions; expressing mathematical statements in the form of simple equations. Solution of equations of first degree in one or two unknowns.

d) Rates, ratios and proportions. Simple and compound interest. Application to population growth etc. Indices.

1.2 Statistical Methods

a) Descriptive statistics: Raw data; frequency distributions, bar charts; frequency polygons, ogives, frequency curves, pictograms and Lorenz curves.

b) Measures of central tendency: Mean, mode and median. Calculations from ungrouped and grouped data.

c) Measures of dispersion: Range, quartile deviation, mean deviation, standard deviation, coefficient of variation.

d) Sampling: Concepts and definitions (frame, population, unit etc.). Simple random, stratified and systematic sampling. Estimation of means, totals and proportions.

1.3 Official Statistics

a) Statistical Organization: Objectives and scope of statistics collected by government; organization of statistical office; management structure; statistical legislation.

b) Review of work done by the various sections of the national statistical office (e.g. agriculture, demographic statistics, labour statistics, household survey, industrial statistics, distributive trade, national accounts, prices, foreign trade, balance of payments, health statistics, education statistics etc.).

The review should cover:

(i) Objectives and scope of work

(ii) Source(s) of data and enumeration units

(iii) Methods of data collection, validation, storage and retrieval

(iv) Methods of presentation of data including data compilation

(v) Uses of data

1.4 Survey Organization (Project work)

a) Designing a survey

(i) Sampling frame - definition, selection

(ii) Methods of collection of data - interviews, postal enquiries, published material, aerial photography

(iii) Census or sample survey, choice of sample size

(iv) Pilot

(v) Design of questionnaires - clarity of layout, ambiguities, computerization, open questions, graded responses

(vi) Design of worksheets

b) Data collection in the field: organization and planning

c) Data processing

(i) Compilation and coding

(ii) Validity checks - historical trends, physical constraints

d) Report writing: general principles, tabulations, graphs, annotation

e) Interpretation: data distortion in presentation, spurious accuracy

f) Types and sources of error in statistical data

2. FIRST STAGE

2.1 Mathematics

Notions of set: definitions, notations, Venn diagram: subsets, empty set, set of subsets of a set, complement, intersection and union of two sets. Natural integers: definition, addition, subtraction, multiplication, division (exact quotient). Quotient plus remainder. Multiples of a natural integer, divisors of natural integer, prime numbers, splitting up a natural integer into prime factors, common divisors to several natural integers, greatest common divisor. Common multiples to several natural integers. Rational numbers: addition, subtraction, multiplication and division. Ratios and proportions. Real numbers: definition, absolute value of a real number. Addition, subtractions, multiplication, division. Order in set of real numbers. Closed and open intervals. Powers of a real number. Roots. Approximations of a real number with integers or decimals. Rounding errors and approximations. Use of tables of square roots, of reciprocals. Linear interpolation. Monomials, polynomials, rational fractions. Algebraic expressions $(a+b)^2$, $(a-b)^2$, $(a+b)(a-b)$. Partial fractions. Equations and inequalities of 1^{st} degree with 1 unknown; equations and inequalities of 1^{st} degree with 2 unknowns. Direct, inverse and joint variation. Σ notation, sequences (of numbers), summation of series including arithmetic

and geometric progressions. Averages and rates. Notions of functions: definition, domain (of definition) of a function, parity, periodicity, increasing and decreasing functions, notions of limit. Study of functions $x \to ax+b$, $x \to ax^2$, and $x \to \frac{a}{x}$. Notions of logarithms. Logarithms. Logarithm of numbers to base 10. Use of table of logarithms. Logarithm of numbers to base e. General factorisation of functions of type ax^2+bx+c. Graphs of linear and quadratic functions. Binomial theorem for integral indices. Trigonometry: Measure of an angle, of an arc. Sine, cosine, tangent, cotangent of an angle, of sum and difference of angles. Introduction to combinatorial analysis: permutations and combinations.

2.2 Basic Economics

The scope of economics. Production, purpose of production, wealth, division of labour. Factors of production. Wages, interest, profit. Supply and demand. Distribution. Banking and finance, currency, foreign exchange. International trade. Public finance, taxation, budget analysis. Economic development planning. World Bank, IMF, ECA. Regional Economic Groupings within Africa.

2.3 English

Comprehension exercises in interpreting statistical reports and manuals. Common English mistakes. Report writing. Other short essays. Drafting of correspondence.

2.4 Elementary Statistical Methods

Descriptive statistics: nature and scope of statistics; tabular presentation of data; frequency distributions; histograms, graphs, and charts. Measures of central tendency: mean, median and mode. Quantiles e.g. percentiles, quartiles and deciles. Measures of dispersion: the range; quartile deviation; mean deviation; standard deviation. Coefficient of variation. Approximate means and standard deviations of functions of random variables (e.g. $Ef(x) \simeq f(\mu)$ $Vf(x) \simeq f'(\mu)\,\sigma^2$. Shapes of distributions, skewness. Time series: definition; characteristics purpose and techniques of analysing time series. Sampling: population - sample distinctions. Basic concepts and definitions: sampling and non-sampling errors; random sampling; systematic sampling; stratified sampling; cluster sampling. Presenting/interpreting statistical data; reports. Index numbers.

2.5 Official Statistics

(Note: In this section as much opportunity as possible will be given to illustrating the Elementary Statistical Methods listed in Section 2.4).

a) STATISTICAL ORGANIZATION

Types of statistical systems: centralised vs decentralised. Functions of a government statistical office. The National statistical Office: historical background, functions and activities. Organizational problems. Statistical legislation. Confidentiality. Integrated statistical systems. Committees: User-producer committees, technical advisory committees, statistical boards.

b) DATA COLLECTION, PROCESSING, ANALYSIS, PUBLICATION AND DISSEMINATION

(i) Sources of data: censuses, surveys and administrative records.

(ii) Organization, design and conduct of integrated multi-subject household surveys

Basic objectives: calendar of operations survey design; preparation of frames (mapping, listing, verification of completeness etc.)

(iii) Organization of field work

(iv) Design of questionnaires and administrative records

(v) Data processing

Data preparation (including clerical operations of scrutiny, editing and coding); data entry (keying verification and data transfer); electronic data processing (automatic machine editing, consistency checks, storage and retrieval of data, tabulation)

(vi) Evaluation of data

(vii) Methods of data analyses, including exploratory data analysis

(viii) Printing and publication of data

(ix) Dissemination of data

c) AGRICULTURAL STATISTICS

(i) Definition and scope of agricultural statistics: the need for agricultural statistics - basic and current agricultural statistics - standards of agricultural statistics.

(ii) Agricultural censuses: objectives - scope and coverage - basic concepts and definitions - programme - tabulation - methodology - uses of agricultural census data.

(iii) Current agricultural statistics: sources of current agricultural statistics - special difficulties - production and producing units - methods of collecting data - timing - use of agricultural census results for developing current agricultural statistics - collection of agricultural statistics through household surveys.

(iv) Crop area and yield statistics: Concepts, definitions and coverage - classification - methods of compilation - mixed and successive cropping - area surveys - methods of estimation - objective measurements (including field work) - crop forecasting.

(v) Statistics of livestock numbers and livestock products: concepts, definitions and coverage - time reference - livestock classification - methods of collecting information - the problem of nomadic livestock - livestock censuses and surveys - meat and by-products - milk products - eggs, wool, hides and skins, silk, honey, etc. - livestock productivity indicators - collection and tabulation of feed statistics.

d) ECONOMIC STATISTICS

(i) National accounts

Concepts and definitions: classification of transactions and transactors, national accounts viewed as a consolidation of the individual accounts of transactors: definition of commodities, industries and activities. Valuation. Typical production account of a business enterprise: definition of value added: GDP at factor cost, at market prices: gross and net domestic product: national and domestic product. Imputations. Capital formation. Consumption expenditure. Sources of data and methods of estimation at current prices: approaches to estimation of GDP; estimation of value added in agriculture; estimation of value added in mining, manufacturing and electricity and water supply; estimation of value added in construction; estimation of value added by producers of government services and nonprofit making bodies; estimation of value added in trade, transport and other services; estimation of value added in real estate and ownership of dwellings; estimation of capital formation; estimation of consumption expenditure. Estimation at constant prices: estimation of GDP at constant prices; estimation of capital formation at constant prices; estimation of consumption expenditure at constant prices.

Main uses of national accounts statistics: national accounts estimates of the country.

Practicals: analysis of profit and loss accounts of a typical business enterprise and estimation of value added: national accounts questionnaires used for collection of data relating to business enterprises and estimation of value added therefrom: typical worksheets used in estimation of value added in agriculture and other major kinds of activity.

(ii) Balance of payments

Definition and basic concepts: definition of residents: economic and imputed transactions: changes in valuation and coverage: the balance of payments and other social accounts.

Basic methodology: double-entry system: problems of classification, valuation, conversion: goods and services: transfer payments: capital account: reserves: standard presentation.

(iii) Industrial statistics

The nature and uses of industrial statistics: sources of data. International Standard Industrial Classification of all economic activities. Statistical Units: the establishment, the enterprise, industrial groupings. Organization and conduct of industrial censuses and surveys. Index of industrial production. Distinction between general industrial statistics and commodity production.

(iv) Price statistics

Nature and role of price statistics. Import, export, factory, wholesale and retail prices. Basic values, producer prices and consumer prices. Collection of price statistics - methods, problems, selection of commodities, outlets and frequency of collection. Construction of consumer price indices. Construction of unit value indices of exports and imports. Price statistics - system of a typical country within the region. Practicals - compilation of price indexes.

(v) International Trade Statistics

Uses of international trade data. Basic concepts and definitions: customs, boundaries, systems of trade, partner country (origin and destination), purchase, sale, consumption, production, supply, collection and compilation of trade statistics. Customs declarations, coding, recording, checking, validation etc. Valuation. Quantity measurement. Commodity classifications.

SITC, BTN (CCC), others. Classification by economic categories: BEC and national end-use classifications: industrial origin. Balance of visible trade. Comparability of international trade statistics. Indices of value, unit value, quantum and terms of trade.

(vi) Labour statistics

Basic concepts, definitions, classification and uses of statistics on: economically active and inactive population: employment, unemployment and underemployment; wages, hours of work, labour cost and employee income; consumer price indices, occupational injuries; industrial disputes. Sources and methods of measurement: household surveys of employment, unemployment and underemployment; household income and expenditure surveys; establishment surveys: administrative and other sources.

(vii) Other economic statistics

Uses, definitions and principal concepts, sources of data, and special indices relating to:

-a Financial and public sector statistics
-b Construction statistics
-c Transport and communications statistics
-d Tourism statistics
-e Distribution statistics

c) (i) DEMOGRAPHIC AND SOCIAL STATISTICS

(i) Demographic statistics

Scope, concepts, definitions, classifications and data collection methods: purpose, scope and uses of demographic data. Sources of demographic and social data - population and housing censuses, continuous population registers, surveys, other administrative records (civil registration, social security records, etc). Types of data collected - demographic, socio-economic, geographic, physical (housing and other infrastructure), health, etc. Definition of population - de facto, de jure, modified de facto. Methods of enumeration - interviewer or canvasser, householder or mail, combination of interviewer and householder methods: individual, group assembly methods. Special techniques for enumerating nomads, semi-nomads and remote-area dwellers. Availability of data - national publications and international agencies (UN and other). Quality of data: evaluation of coverage - direct and

indirect methods - balancing equation: sampling and other selection errors: content errors - age, sex, fertility, mortality and migration data; memory lapse; bias and deficiences in data; not stated and unknown categories; grouped values. Introduction to demographic data presentation: bar charts, population pyramid, curves - Lorenz and Pareto - and Pie diagram; density charts and dot diagrams; nomograph: Lexis diagram: migration flow charts; use of logarithmic and semi logarithmic papers. Elementary analysis of data: means - age of population, household size, number of children ever born (parity), age of fertility (m), age (of mother) at birth (M), singulate mean age at marriage, centre of population. Median - age of population, household size, number of children ever born, age and marriage. Rates - birth, death, migration and growth (arithmetic, geometric, exponential). Participation rate (enrolment, activity, headship). Specific rates - fertility, mortality, migration. Gross and net reproduction rates, infant mortality, still birth and foetal death. Refined and standardised rate - indirect and direct. Sex age adjusted birth rate. Synthetic fertility schedule. Probability of surviving and other life table measures, expectation of life at birth and at other ages. Separation factors. Ratio - population density, child woman ratio, dependency ratio, age and sex ratios, survival ratios (cohort and overall). Standardisation. Percentages - age distribution, fertility. Comulated percentage distribution. Index number - indices of digit preference (Whipples, D.P.I., Myers), U.N. age accuracy index, Gini index of concentration, J index, replacement index.

(ii) Education statistics

Purpose, principles, procedures and problems of collecting education statistics in Africa. Concepts, definitions and classifications; the International Standard Classification of Education (ISCED). Data Needs. The Annual School Census: the Statistical Infrastructure, Design of questionnaires. Verification, compilation and publication of education statistics. Rates and Ratios used in analysing statistics on pupils and teachers; enrolment ratios (level enrolment ratios: age-specific enrolment ratios). Analysis of pupil flows. Pupil-teacher ratios.

(iii) Health statistics

Objectives and utilization of health statistics by health administration at local, national and international level. Morbidity statistics (regular sources, different sources, notification of infectious diseases, hospital statistics, statistics of ambulatory services, rates). Medical records. Mortality statistics (Certificate of death, specific rates of cause of death, International Classification of Diseases). Statistics of health services (definitions of health facilities, equipment, material and personnel, finances, resources and expenses).

(iv) Other social statistics

Scope, uses, concepts, definitions and classifications; sources of data. Different types of questionnaires used and methods and problems of data collection in connexion with:

-a Criminal statistics
-b Social security and welfare statistics
-c Housing statistics
-d Environment statistics

3. SECOND STAGE

3.1 Economics

Microeconomics: definitions; scarcity and choice; market structures; location and size of firm - types of business organizations.

Macroeconomics: money, barter, banks and other financial institutions - their nature and their role.

Taxation: introduction to monetary and fiscal policies, currency exchange rates and special drawing rights; tariffs and non-tariff barriers.

Applied economics: characteristics of underdevelopment; the least developed of the developing countries; Rostow's stages of economic growth; economic policies (country case study); agricultural and industrial development (country case study); economic dualism; balanced growth; unemployment; economic planning in Africa (with special reference to the country); economic systems.

Principal world products: production and exports of basic agricultural products, minerals, other raw materials and energy.

World traffic: major land, sea, and air routes; relations between states; important road and railway links in Africa; the Trans-Africa Highway.

3.2 Mathematics

Principle of mathematical induction. Equations of 2^{nd} degree with 1 unknown. Existence and calculation of roots, sum and product of roots. Binomial theorem of negative integral and fractional indices.

Notions of limits: limit of a function when the variable tends towards a given real number, towards infinity. Limit of sum, product, and quotient of functions (without proof).

Notions of continuity: continuity of a function at a point, in an interval; sum, product, and quotient of continuous functions (without proof).

Derivative: derivative of a function, differential notations. Derivative of sum, product, quotient and power of functions (without proof). Geometrical interpretation of a derivative. Increasing and decreasing functions; asymptotes. Maxima and minima of a function. Derivative of the reciprocal of a function. Use of derivatives to approximate to a function e.g. $f(a+h) \simeq f(a) + hf^1(a)$.

Notions of integral calculus: primitives - definitions and calculations; primitives of simple functions. Equalities $\int_a^b f(t)\,dt = F(b) - F(a)$ where f is a continuous function in (a,b) and F a primitive. Integration by parts: mean value theorem. Improper integrals. Partial differentiation. Double integration over rectangular and triangular regions. Differentiation and integration of trigonometric and inverse trigonometric functions.

Logarithmic and exponential functions: definitions, properties, graphic representation. Power series. Logarithmic and exponential series. Limits of sequences and series.

Introduction to linear algebra: vector space defined on the set of real numbers, notion of independence, bases. Study of the real vector space. Linear function, matrix representation of a linear function. Trace and rank of matrix. Study of matrices 2x2 with real coefficients. Sum, product, multiplication of a matrix by a real number. Inversion of a non-singular matrix. Application to solving simultaneous equations. Expression of simple quadratic forms as matrices.

Complex numbers: definition of a complex number in the form $x+iy$. Trigonometric form of a complex number notation $r(\cos\theta+i\sin\theta)$, calculation of $\cos n\theta$, $\sin n\theta$, where $n = 2,3,4$.

Geometry: Axis, reference basis (or reference axis). Vector calculations in the plane, co-ordinates, co-linear vectors. Straight line in the plane, vector determination, parallel straight lines. Cartesian equation of a straight line.

Equation of a straight line defined by a point and a directing vector. Dot product of two vectors, definitions and properties. Orthogonal vectors, distance of two points, distance of a point to a straight line. Normal vector to a straight line. Use of calculators/computers including use of packages for simple tabulation, extraction of summary statistics etc.

3.3 Statistical theory and methods

Other measures of central tendency: geometric mean. Comparative study of mean, median, and mode. Mesures of dispersion: coefficient of variation. Moments and skewness.

Probability: sample spaces, random variables, joint discrete random variables, conditional probability, expectation, variance, moment generating functions, covariance; Some standard distributions: binomial, poisson, normal, geometric, and exponential - and their important properties.

Statistical inference: point estimation. Unbiasedness in estimations. Confidence intervals. Hypothesis testing. Use of normal, X^2, t and F tables. Type I and Type II errors. Go dness-of-fit tcsts for independence and for fitting of distributions.

Linear Association: regression and correlation coefficients; fitting a straight line; least square estimation of regression coefficient. Hypothesis testing relating to estimates, calculation of coefficient of correlation and its interpretation. Spearman's rank correlation. Introduction to joint bivariate distributions - examination of two-way tables.

Index number and rates: simple and weighted averages of price relatives; construction of indices (Laspeyres, Paasche) and their limitations; chained indices, crude and standardized rates and their uses.

Time series: secular trend, seasonal and cyclical movements together with random or residual error; elementary methods including moving averages for estimating these components; correcting a time series for seasonality.

Sampling: basic concepts and definitions, sampling and non-sampling errors. Pilot surveys. Random, systematic, stratified, cluster and multi-stage sampling; estimation of the characteristics of a population from a sample; precision (standard errors of estimated means, proportions, sums and differences) and costs.

3.4 Elements of accounting

The importance of accounts as records of transactions and as aids to efficient management. Recording of transactions: books of original entry, sources of information, documents used: analysis columns: the cash book, petty cash book, records of bank transactions, reconciliation of bank balances, the budget and its maintenance, interpretation of ledger accounts: the trial balance; suspense account. Distinction between nominal and personal accounts: profit and loss accounts. Preparation and interpretation of the balance sheet. Application of sampling techniques to company records and to auditing.

3.5 Applied statistics

a) AGRICULTURAL STATISTICS

(i) Land utilization statistics. Concepts and definitions - classification - sources of information - methods of collecting information - uses - statistics of irrigation - aerial photography, area frame, measuring instruments.

(ii) Agricultural trade statistics. Concepts and definitions and coverage - time reference - commodity classification - customs area and partner countries - sources of data.

(iii) Agricultural price statistics. Concepts and definitions - sources and methods of collecting agricultural price data - prices paid by farmers - prices received by farmers - wholesale and retail prices - index number of prices.

(iv) Agricultural population, labour force and wages. Concepts and definitions - agricultural population as related to farm and rural population - agricultural labour force - agricultural wages methods of collection of data - projections.

(v) Statistics on agricultural inputs. Sources of information - methods of collecting fertilizer data - fertilizer experiments - methods of collection of pesticides, agricultural machinery and equipment statistics.

(vi) Fishery statistics. Sources of fishery information - methods of collecting fishery data - fishery surveys - estimation of fishery production.

(vii) Forestry statistics. Sources of forestry information - methods of collecting forestry data - forestry censuses and surveys - estimation of forestry production.

(viii) Food consumption statistics. Concepts and definitions - sources of food consumption data - economic grain equivalent - nutritive values - nutritional requirements - food consumption surveys - measuring techniques.

(ix) Food balance sheets and production/utilization accounts. Concepts and definitions - procedure for preparation - standardization problems.

b) PUBLIC SECTOR AND FINANCIAL STATISTICS

Definition of the public sector: central and local government, public enterprises. Definition and role of the regular and extraordinary budgets. Public receipts and expenditure, deficit financing, public debt. Financial institutions: types and uses of data.

c) INDUSTRIAL STATISTICS

Directories and their updating: collection and sources of data; index of industrial production: labour productivity. Surveys of household and small-scale industries.

d) NATIONAL ACCOUNTS

Basic notions; production, intermediate and final products: gross and net output, value added, gross, net, national and domestic values at market prices and factor cost. Use of the gross product. Consumption and accumulation: fixed capital and stocks, finance of production. Consolidated accounts of the nation: matrix presentation and double entry; characteristics of the United Nations system of national accounts (SNA), transactors of the system, standard accounts and tables and the relationships between their elements; definition of aggregates and principal flows. Introduction to input-output tables.

e) LABOUR AND EMPLOYMENT STATISTICS

Basic concepts and definitions; economically active and inactive populations; demand and supply of labour: indices of employment unemployment and underemployment; hours of work; wage rates; social security arrangements: industrial accident rates; industrial disputes. International and national classification of occupations.

f) TRANSPORT AND COMMUNICATIONS STATISTICS

Nature and use of transport and communications statistics, sources and methods of collection: concepts and definitions in shipping, road, rail and air transport; registered tonnage, loading, unloading, international and domestic trade, transit, traffic performance; ton-kilometres, volume and capacity measurements; passenger journeys; passenger-kilometres; rolling stock, operating ratios; accidents. Censuses of traffic, network and shipping registration. Evaluation of infrastructure. Fixed capital formation.

g) DEMOGRAPHY

Models: growth models - arithmetic, geometric, exponential, modified exponential, Gompertz, logistic; special functions - Makeham's law, Paretos' curve; model life tables - U.N. and Coale-Demeny. Simple interpolation: equal and unequal intervals, Warings formula; extrapolation; graphic methods; osculatory interpolation formulae - Karup - King, Sprague. Smoothing and adjustment of data: Newton's halfing formula and other interpolation techniques, prorating; oblique axis method; Carrier-Farrag ratio methods; moving averages - three point and UN five point formulae (secretariat method); logit transformation and use of models; Chandra Sekar-Deming formula. International and internal migration: concepts, definitions, classifications and measurement. Morbidity. Simple projections and population estimates: mathematical curves - linear, curvilinear, exponential, logistic. Gompertz; simple cohort projection using model life tables and sex age adjusted birth rates or synthetic fertility schedule. Implications of population growth: growth rate, age sex composition, density; impact on education and labour force; dependency ratios; demand for food, housing, health and other social amenities.

h) HEALTH STATISTICS

Definition and scope of vital and health statistics. Their importance in planning and evaluation of health services, in measurement of effectiveness of preventive measures and clinical treatment, in defining and in study of existing health problems.

Organization of health services. Principles of health administration; health facilities and health personnel; principles of health legislation.

General principles of a health statistics system: fields of health statistics; sources of information: recording and reporting: presentation, analysis and uses of health statistical information; principles of health statistical administration; health statistical personnel and their responsibilities.

Introduction to medical terminology: selected disorders and general abnormalities; description of diseases frequently reported on death certificate, notification and other reporting forms; lay reporting.

Sources of data: health service records; notification and individual reports; registration, periodical summary reports: special field surveys: census (health personnel, health facilities).

Health services and their activities (scope and purpose: indicators of). Morbidity (measurement of: recommended definitions; duration of illness: recurrence and multiple morbidity); sources of morbidity data, their uses and interpretation.

Classification of diseases and causes of death (the need for classification; principles of a statistical classification of disease: International Classification of Diseases: general principles, history, special tabulation lists).

Census and surveys methods: design of questionnaires; sampling techniques: need for pilot studies; sources of bias: field trials of prophylatic and therapeutic procedure.

3.6 Project work

Each candidate will undertake a three week supervised project connected with the branch of statistics in which he works. The project could cover any of the elements of the course such as evaluation of data collected and design of questionnaires.